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Editorial Comment

Coronary Angioplasty as the Preferred Approach to Treatment Of Multivessel Disease: Promising, Appealing But Unproved*

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In 1989 approximately 600,000 persons in the United States underwent coronary revascularization with almost equal numbers of patients treated with percutaneous transluminal coronary angioplasty (PTCA) and coronary artery bypass surgery. The role of surgery in comparison with an initial strategy of medical therapy was the focus of several large randomized trials and multiple registry and data bank studies in the 1970s and 1980s. As a result, the impact of coronary bypass surgery in comparison with medical therapy on survival and symptom relief in different patient subsets has, by and large, been clarified (1). The emphasis in the 1990s has shifted toward identifying the preferred method of revascularization—whether this be coronary angioplasty or bypass surgery (2–4). The controversy is particularly relevant in patients with multivessel disease, who now represent a large segment of the group undergoing balloon angioplasty (3–14).

The present study. The report by O'Keefe et al. (15) in this issue of the Journal is timely and important but also highlights the relative paucity of published data on which the decision to perform surgery or angioplasty must be based. Regrettably, approximately 11 years after the initial use of coronary angioplasty, we do not yet have results from randomized trials and, in the absence of such data, have to rely on the reported results of clinical experience. In this regard the series by O'Keefe et al. (15) can serve as a benchmark for comparison with other published data. It should be kept in mind, however, that individual series that are characterized by expertise and excellence also remind us of the importance of comparative studies and randomized trials that take into account the vagaries and biases involved in the selection of patients for a particular procedure.

Patient Selection Criteria

Double versus triple vessel disease. Multivessel disease should not be viewed as a homogeneous clinical entity. The natural history of patients with double or triple vessel disease can vary and there are major differences in the distribution of double or triple vessel disease in patients who undergo angioplasty in comparison with those who have coronary artery bypass surgery. For example, among angioplasty patients with multivessel disease, triple vessel disease was present in 41% of patients in the recent cohort of the National Heart, Lung, and Blood Institute's (NHLBI) PTCA registry (5); 26% in the series of Deligonul et al. (6); 21% in the Emory University Hospital experience from 1985 to 1988 (4); and in 38% of 867 patients at our own institution (Bell M, personal communication, June 1990). In contrast, in large series of patients undergoing coronary bypass surgery, triple vessel disease was present in 62% of patients in the Coronary Artery Surgery Study (CASS) registry (16); 62% (excluding patients with left main coronary disease) in the Emory University Hospital series (4); 79% in the Cleveland Clinic experience of the first 1,000 patients who had bypass surgery in 1990 (Loop FD, personal communication, June 1990); and in 78% of patients in a single surgeon's series at the Mayo Clinic (Schaff HV, personal communication, June 1990). It appears, therefore, that in reported surgical series approximately two thirds of patients with multivessel disease have triple vessel disease; the reverse is evident in the coronary angioplasty experience. In the study of O'Keefe et al. (15) there is a predominance of triple vessel disease (54%) but this is probably a partial consequence of their inclusion criteria because patients with two vessel disease who underwent dilation of only one vessel were specifically excluded and categorized as having had single vessel angioplasty (5).

Role of left ventricular dysfunction. In many comparative studies of bypass surgery and medical therapy, left ventricular dysfunction has emerged as a powerful determinant of late prognosis (1). Moreover, in patients with left ventricular dysfunction and multivessel disease surgery has been found to be associated with improved morbidity and mortality in comparison with medical therapy (1). The role of angioplasty in similar patients with multivessel disease and left ventricular dysfunction has not been adequately addressed in many large reported angioplasty series. For example, only 19% of patients in the recent cohort in the NHLBI PTCA registry (5) had an ejection fraction <0.50, a percentage similar to the 23% in the Mayo Clinic experience, and only 12% of patients in the series of O'Keefe et al. (15) had an ejection fraction

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<0.40. In the 1988 experience at Emory University (4), an ejection fraction <0.50 was present in only 15% of patients undergoing angioplasty in contrast with approximately 30% in surgically treated patients. However, this predilection to perform angioplasty in patients with relatively well preserved left ventricular function is appropriate because the acute consequences of angioplasty failure, namely, emergency coronary bypass surgery or acute myocardial infarction, although somewhat infrequent, become far more serious in patients with preexisting left ventricular dysfunction (17). Although the current tendency to perform angioplasty primarily in patients with double vessel disease and in those with good left ventricular function may well be prudent, this does highlight the potential for error in using the published literature to draw comparisons between the results of the two procedures in multivessel disease. To their credit, O'Keefe et al. (15) do not make any direct comparisons and correctly emphasize the importance of randomized trials of coronary angioplasty and bypass surgery that are under way.

Results of Angioplasty

Early results. The low mortality and short-term complication rate in the series of O'Keefe et al. (15) attests to the expertise and experience of the investigators and was similar to that achieved in patients with single vessel disease except for the surprisingly low incidence of necessity for bypass surgery in patients with multivessel disease. Their complication rate is lower than that reported in other series of patients with multivessel disease and contrasts with the experience in the NHLBI PTCA registry (18), in which morbidity and mortality were higher with an increasing number of diseased vessels. The latter finding is not surprising because many complications are lesion related and not entirely patient specific; the apparent discrepancy between the two series probably relates to differences among the patient groups. As stated by the authors (15), patients with multivessel disease in whom the procedure was aborted after a complication during angioplasty of the initially dilated vessel were not included in this report but categorized under "single vessel angioplasty." This definition led to improved results in patients with multivessel disease and could account for some of the differences between the results in this series and those of other published studies. It would be interesting to know how many patients with multivessel disease actually were in the group in which the procedure was aborted after failed angioplasty of the initially dilated vessel; the morbidity and mortality in this subset are also relevant and would be of interest.

Late outcome. The late outcome of the patients in the series of O'Keefe et al. (15) was very favorable, although the data may be somewhat skewed by the exclusion of patients with multivessel disease who had fewer than two dilated lesions. These inclusion criteria result in a relatively high incidence of complete revascularization in comparison with patients in the NHLBI PTCA registry (5). Nonetheless, perhaps the most encouraging aspect of these data is that only 16% of patients underwent coronary artery bypass surgery at 5 years and the majority of restenoses apparently responded to repeat dilation with good late functional outcome. Overall, event-free survival, defined as freedom from death, myocardial infarction or need for surgery, was also encouragingly low, although the definition of infarction was limited to Q wave infarction. In any analysis of the immediate results of the procedure it is reasonable to exclude non-Q wave infarction, because it is difficult to identify this during the perioperative period of coronary bypass surgery. However, in regard to late outcome, any hospital admission precipitated by prolonged chest pain in association with a rise in cardiac enzymes consistent with infarction should be categorized as infarction whether or not Q waves develop.

Conclusions. Coronary angioplasty is safe and effective and will continue to be used in selected patients with multivessel disease. Emerging technology and, particularly, any reduction in the incidence of restenosis will expand to utility. If other studies can document that for most patients who undergo angioplasty coronary bypass surgery can be postponed for several years without compromise to quality of life, then the value of angioplasty in multivessel disease will undeniably be enhanced.

Nonetheless, it should be emphasized that the specific indications for coronary angioplasty in the wide spectrum of patients with multivessel disease remain undefined. Rigorous scrutiny of randomized trials, including analyses of nonrandomized patients entered into a registry, may not provide all the answers but will probably clarify the issues further in specific subsets of patients. Until the results of these studies are available, the data from large series such as that from O'Keefe et al. (15) are helpful and needed.

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